MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018 / 2019

PEM0046 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Engineering)

31 MAY 2019
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **FIVE** printed pages including the cover page.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary working steps **MUST** be shown.
4. Statistical table is provided.

Answer ALL questions [100 marks].

QUESTION 1 [25 marks]

a. A bag contains four red and three blue marbles.
TWO marbles are drawn from the bag, without replacement.

i. Tabulate the probability distribution of the number of **blue marble** obtained. (4 marks)

ii. What is the probability that both marbles obtained are the **same** colour. (2 marks)

b. The probability distribution of the random variable X is given in the following table, where c is a constant.

X	1	2	3	4	5
$P(X=x)$	c^2	2c	c^2	c	8/25

i. Prove that there is only one possible value of c, and state the value c. (4 marks)

ii. Hence, find the cumulative distribution of random variable X. (2 marks)

iii. If c is 0.2, find the expected value and the standard deviation of this probability distribution. (6 marks)

c. Consider the probability density function for continuous random variable X,

$$f(x)=\begin{cases} 2x^2(k-2x) & ; \quad 0 \le x \le 1 \\ 0 & ; \quad \textbf{otherwise} \end{cases}$$

i. Show that the value of the constant k is 3. (4 marks)

ii. Find the probability that X is between 0 and 0.5. (3 marks)

Continued...

QUESTION 2 [25 marks]

a. The random variable X has a binomial distribution with $n = 6$ and $p = 0.3$. Calculate

i. $P(X = 2)$. (2 marks)

ii. $P(2 < X \leq 5)$. (3 marks)

iii. the mean and standard deviation of the variable X. (2 marks)

b. The average number of homes sold by the H-Tech Realty Company is 2 homes per day.

What is the probability that

i. exactly 3 homes will be sold tomorrow? (3 marks)

ii. at least 2 homes will be sold on next Friday? (3 marks)

iii. more than 10 homes will be sold in first week of the next month. (4 marks)

c. A researcher has been collecting data on the heights of a particular bonsai (Shito Bonsai). He has observed that **12.3%** of the bonsai are above 8 cm in heights and **20.9%** of the bonsai are below 6 cm in heights. He assumes that the heights are normally distributed.

Find the mean and standard deviation of the distribution. (8 marks)

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QUESTION 3 [25 marks]

a. Adam's family consists of five members. The time taken for each member in the family to commute to work daily is as follows:

Member	Adam	Bell	Cindy	Dell	Edwin
Times (in minutes)	15	20	10	20	5

i. Calculate the population mean commuting time μ. (2 marks)

ii. Take a sample of the following members: Bell and Cindy.
Find the sample mean commuting time $\bar{x}$ and the sampling error. (3 marks)

Consider all possible samples of **size two** which can be drawn without replacement from this population (Adam's family).

iii. List all the possible samples of size two from this population, and hence determine the sample mean. (5 marks)

iv. Tabulate the sampling distribution of the sample mean. (3 marks)

b. Suppose the monthly salaries of all employees in a large company are normally distributed with a mean of RM5500 and a standard deviation of RM2000.
Suppose we take samples of size 30 employees.

Find the probability that the sample mean salary

i. will not be more than RM5500. (2 marks)

ii. will exceed RM6000. (3 marks)

iii. will be between RM4900 to RM5300. (3 marks)

iv. will be less than the population mean by at least RM1000. (4 marks)

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QUESTION 4 [25 marks]

Jonathan is a second hand car dealer. He has 10 cars for sale. He decides to investigate the link between the age of the cars, x (years), and mileage, y (thousand miles). The data collected from the cars are shown in the table below.

Age of The Cars, x (Years)	2	2.5	3	4	4.5	4.5	5	3	6	6.5
Mileage of The Cars, y (Thousand Miles)	22	34	33	37	40	45	49	30	58	58

a. Draw a scatter diagram of y against x, on the graph paper provided. (2 marks)

b. Find the equation of the regression line in the form of $y = a + bx$.
Give the values of a and b in 2 decimal places. (14 marks)

c. Hence, graph the regression line on the scatter diagram. (2 marks)

d. Using your answer in part (b), find the mileage predicted for a 5 years old car. (2 marks)

e. Find the correlation coefficient between x and y and conclude your finding. (5 marks)

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